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#16 Appeal Brief T. Young 8-22-02

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: NAKAO et al.
Serial No	: 09/485,017
Filed	: April 6, 2000
For	: CORIOLIS MASS...
Art Unit	: 2855
Examiner	: C. Dickens
Dated	: August 12, 2002

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

APPEAL BRIEF

I. REAL PARTY INTEREST

This application is assigned to Oval Corporation, 10-8 Kamiochiai 3-chome, Shinjuku-ku, Tokyo, 161-8508 Japan.

II. RELATED APPEALS AND INTERFERENCES

Appellant, Appellant's legal representative, or Assignee has no knowledge of any appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1 - 19 stand rejected and are on appeal.

IV. STATUS OF AMENDMENT AFTER FINAL REJECTION

No Amendment After Final Rejection was submitted. A telephone interview was conducted with the Examiner. No agreement was reached.

V. SUMMARY OF THE INVENTION

The present invention is a meter to measure a mass flow through a tube. In particular the present invention takes advantage of the Coriolis force which is well known in physics. In particular the Coriolis force is taken advantage of as a fluid flows through a vibrating tube. A tube is held fixed between two end points. The middle of the tube therefore moves back-and-forth but the end points remain stationary. In the non-vibrating state, the tube is substantially straight in a very simple Coriolis mass flow meter. As the tube vibrates, the tube assumes a bow shape at its extreme positions of vibration. Correspondingly, the center of the tube has the greatest transverse velocity in the vibration mode. The transverse velocity diminishes as the distance to the ends of the pipe diminish.

As fluid flows through a tube which is moving from its center position to its extreme bowed position, the fluid experiences a transverse force or velocity. The fluid starts off with a zero transverse velocity as it enters the tube. As it proceeds towards the middle of the tube, the tube tries to push the fluid in the transverse direction. The fluid, because of inertia and mass resists this transverse push. The larger the mass flowing through the tube, the more resistance the tube experiences to moving in the transverse direction. The first half of the tube therefore tends to lag when the tube is moved in the transverse direction. The larger the mass flowing

through the tube, the greater the lag. Once the fluid has reached the middle of the tube, the transverse velocity of the tube and of the fluid is at its greatest. The transverse velocity of the tube then diminishes to zero as the position of the tube gets closer to the far fixed end of the tube.

The fluid in the tube on the other hand has its largest transverse velocity as it passes through the center of the tube. The portions of the tube past the center then try to slow down the transverse velocity of the fluid. However, the fluid has a higher transverse velocity, and therefore the fluid tends to push this portion of the tube further in the transverse direction. The greater the mass, the more the fluid tends to push the tube against the decreasing transverse velocity.

Therefore fluid flowing through a vibrating tube which is fixed at each end tends to be deformed in the first half away from the transverse direction, and deformed in the second half towards the transverse direction. This deformation depends on the mass flow through the tube. At zero mass flow, there is no deformation from the bow shape. However the higher the mass flow, the more deformation occurs. This deformation can be measured and the mass flow through the tube can be calculated. Coriolis mass flow meters and their principals of operation are well known in the art.

In order to more easily measure the deformation in a tube flowing fluid, the present invention uses two parallel curved flow tubes 1, 2, page 5 lines 5 - 6. Fluid flows into a manifold 24 through a flange 18 and is divided equally at the inlet side manifold 24 to the two flow tubes 1 and 2, page 9 lines 8 - 10. The fluid flows through the two flow tubes 1 and 2 and

is joined together in outlet side manifold 25 and exits through flange 19, page 9 lines 10 - 12.

A drive unit 15 causes one of the flow tubes to resinate with the other flow tube in an opposite phase with each other, page 5 lines 6 - 7. In particular drive unit 15 first pushes the flow tubes 1 and 2 apart, and then pulls the flow tubes 1 and 2 back together. In a preferred embodiment, the drive unit 15 is positioned halfway between the inlet and outlet manifolds, at the point where the flow tubes reach their maximum transverse position. Vibration sensors 16 and 17 are positioned between the flow tubes on opposite sides of the drive unit 15. When no fluid is flowing through the flow tubes 1 and 2, the flow tubes vibrate identically and the vibration measured at sensor 16 is substantially equal to the vibration measured at sensor 17. However when fluid flows through the flow tubes, the fluid initially starts off with a zero transverse velocity. When the flow tubes vibrate, they have a transverse velocity which increases, and preferably reaches a maximum at the drive unit 15. For the sake of this discussion, we will analyze the behavior of the flow tubes as the flow tubes move away from each other.

The fluid entering into the flow tubes as the flow tubes move away from each other, has a zero transverse velocity. This tends to hinder or slow down the flow tubes as they move away from each other. As the fluid moves past the drive unit 15 and the point of maximum transverse velocity, the fluid tends to still want to move in the transverse direction, however, the velocity of the flow tubes is starting to decrease. The fluid therefore tends to push the flow tubes further away from each other past the drive unit 15. During a movement of the flow tubes away from each other, the fluid in the first half of the flow tube tends to keep the flow tubes closer

together, and the fluid in the flow tubes past the drive unit tends to keep the flow tubes further away from each other. The vibration sensors 16 and 17 detect this deformation because the vibrations are therefore not of the same magnitude at the same time, but actually appear to be at a phase with each other. By positioning the two flow tubes in a curve, and in planes that are parallel to each other, measuring the deformation caused by the Coriolis affect is simple and accurate, especially when two vibration sensors are placed on opposite sides of the drive unit 15. An important feature of the present invention is therefore the manifold dividing the flow into two curved parallel flow tubes, and then an outlet manifold joining the flow from the two flow tubes. However, this is not the only important feature of the present invention.

VI. CONCISE STATEMENT OF ALL ISSUES PRESENTED FOR REVIEW

Whether claims 1 - 19 are unpatentable under 35 USC § 103 over Hasegawa et al..

VII. GROUPING OF CLAIMS

Applicant asserts that each of claims 1 - 19 rejected under 35 USC § 103 are separately patentable.

VIII. ARGUMENT

Whether claims 1 - 19 are unpatentable under 35 USC § 103 over Hasegawa.

Claim 1 sets forth two parallel curved flow tubes and an inlet side manifold branching from an inlet of a fluid being measured into said two flow tubes. The rejection equates two

parallel curved flow tubes of claim 1 with elements 2a and 2b of Hasegawa. The rejection equates the inlet of claim 1 with element 3 of Hasegawa. It appears that the structure defining element 3 and the structure connecting the passage of element 3 to element 2a are also equated with the manifold of claim 1. Applicant notes that this structure in Hasegawa is not a manifold. This is especially true with regard to the manifold of claim 1 which sets forth that the inlet side manifold branches from an inlet to the two flow tubes.

With this Amendment Applicant is enclosing page 1169 from Webster's New Universal Unabridged Dictionary Copyright 1996 which provides the definition of a manifold. Applicant has highlighted definition number 9 relating to machinery. This definition indicates that a manifold is a chamber having several outlets through which a liquid or gas is distributed or gathered. Applicant has reviewed the structure surrounding element 3 in Hasegawa, and finds no teaching nor suggestion of several outlets through which a liquid or gas is distributed or gathered. Applicant notes that claim 1 clearly sets forth that the manifold branches to the two flow tubes. The structure surrounding element 3 in Hasegawa does not branch to two flow tubes. Instead the structure surrounding element 3 in Hasegawa only connects to element 2a. Therefore Hasegawa does not have a manifold branching from an inlet to two flow tubes. Hasegawa therefore cannot anticipate claim 1.

Claim 1 also sets forth an outlet side manifold for joining fluid flows flowing in the two flow tubes. The rejection appears to equate the structure surrounding element 4 of Hasegawa with the outlet side manifold of claim 1. This structure is not a manifold. As described above, a manifold has several outlets through which liquid or gas is distributed or gathered. The

structure surrounding element 4 does not have several outlets through which liquid or gas is distributed or gathered. The outlet side manifold of claim 1 specifically sets forth joining fluid flows flowing in the two flow tubes. Applicant finds no teaching nor suggestion of the structure surrounding element 4 in Hasegawa of joining fluid flows flowing in two flow tubes, and therefore the structure surrounding element 4 in Hasegawa is not similar to the outlet side manifold of claim 1. Claim 1 therefore further defines over Hasegawa.

Claim 1 also sets forth base plates connected to the two flow tubes to form first vibration fulcrums. Claim 1 also sets forth that joint parts between the inlet side and outlet side manifolds and the flow tubes serve as second vibration fulcrums. Since Hasegawa does not teach a manifold with a plurality of outlets or connected to two tubes, Hasegawa cannot describe a joint part between two tubes, therefore Hasegawa cannot describe such points as being second vibration of fulcrums. Claim 1 therefore further defines over Hasegawa.

Claim 1 also sets forth a meter body. In the embodiment of Figures 1 - 3 the meter body is represented by reference 30 in the present application. Claim 1 sets forth that the meter body is connected to the inlet and outlet side manifolds only at the inlet and outlet sides of respective manifolds. This is done so that the joint parts between the flow tubes of the inlet and outlet side manifolds can be isolated from the meter body. Applicant finds no teaching nor suggestion of any structure in Hasegawa which isolates a joint between flow tubes of a manifold from a meter body. Claim 1 therefore further defines over Hasegawa.

Independent claim 11 sets forth an inlet manifold. As described above, Hasegawa does not have an inlet manifold. Claim 11 therefore defines over Hasegawa.

Claim 11 also sets forth that the inlet manifold has an inlet side with a single port and that the inlet manifold has an outlet side with first and second ports. The structure surrounding element 3 in Hasegawa clearly does not have an inlet side with a single port, and an outlet side with first and second ports. Claim 11 therefore further defines over Hasegawa.

Claim 11 further sets forth that the first flow tube has an upstream end connected to the first port of the inlet manifold, and sets forth a second flow tube having an upstream end connected to a second port of the inlet manifold. Since Hasegawa does not have an inlet manifold with first and second ports, Hasegawa clearly cannot have first and second flow tubes connected to those ports. Applicant notes that elements 2a and 2b of Hasegawa therefore do not have the same relationship to the structure surrounding element 3 as the first and second flow tubes with the inlet manifold of claim 11. Claim 11 therefore further defines over Hasegawa.

Claim 11 also sets forth an outlet manifold with an inlet side with first and second ports. The outlet manifold is substantially a mirror image of the inlet manifold. Applicant finds no teaching nor suggestion of an outlet manifold in Hasegawa, and therefore claim 11 further defines over Hasegawa.

Claim 11 also sets forth that a connection between the first and second ports of the inlet manifold and a connection between the first and second ports of the outlet manifold forms second vibration fulcrums. Hasegawa does not teach nor suggest first and second ports on an inlet or an outlet manifold, and therefore Hasegawa cannot teach nor suggest second vibration fulcrums. Claim 11 therefore further defines over Hasegawa.

During discussions with the Examiner, the Examiner referred to Figure 8 of Hasegawa as possibly disclosing a manifold. During this discussion, the Examiner indicated that elements 12a and 13a would then be equated with the first and second flow tubes of the present invention. Applicant has reviewed this possibility and notes that independent claims 1 and 11 set forth a drive unit vibratable of the first and second flow tubes in opposite phase to each other. Applicant's review of Figure 8, finds no teaching nor suggestion of a drive unit vibratable of elements 12a and 13a in opposite phase to each other. Applicant notes that Figure 8 includes vibrators 21 and 22. However, these vibrators are not similar to the drive unit of claims 1 and 11. Vibrator 21 of Figure 8 vibrates element 12a with respect to 12b. Vibrator 21 does not have any effect on element 13a. Likewise vibrator 22 vibrates element 13a with respect to 13b. If 12a and 13a of Figure 8 are equated with the first and second flow tubes, then Figure 8 has no drive unit which is vibratable of first and second flow tubes in opposite phase to each other. Therefore Figure 8 does not describe the invention of claims 1 and 11.

Claim 12 sets forth that the drive unit of claim 11 vibrates the first and second flow tubes toward and away from each other. If elements 12a and 13a of Figure 8 of Hasegawa are equated with the first and second flow tubes, Hasegawa does not have a drive unit which vibrates elements 12a and 13a toward and away from each other. Claim 12 therefore further defines over Hasegawa.

Claim 13 sets forth that the meter body is spaced from the first and second ports of the inlet and outlet manifold. Applicant notes that the rejection equates the base plate of the present invention with element 5a of Hasegawa. The rejection also indicates that the meter

body of the claims is disclosed in Hasegawa in column 5 lines 60 - 64. Applicant has reviewed this portion of Hasegawa, and notes that this portion describes a bracket 5a. It appears that the rejection is using the same structure 5a and Hasegawa to anticipate both the base plate and the meter body of the claims. Applicant notes that the meter body of the claims has separate relationships with the flow tubes than the base plate of the claims. In particular claim 13 setting forth that the meter body is spaced from the first and second ports of the inlet and outlet manifold further distinguish from Hasegawa.

Claim 14 sets forth that the first and second ports of the inlet manifold and of the outlet manifold are spaced from each other. Hasegawa does not teach nor suggest first and second ports of either an inlet manifold or an outlet manifold, and therefore cannot teach nor suggest such ports being spaced from each other. Claim 14 therefore further defines over Hasegawa.

Claim 15 sets forth that the drive unit includes a magnet connected to the first flow tube and a coil connected to the second flow tube. Each of the sensors include a magnet connected to the second flow tube and include a coil connected to the first flow tube. Applicant has reviewed Hasegawa, and finds no teaching nor suggestion of how any structure similar to a drive unit is constructed. Therefore Hasegawa cannot anticipate claim 15. Claim 15 therefore further defines over Hasegawa.

Claim 16 sets forth that the first and second flow tubes have a U-shape. Applicant notes that the if elements 2a and 2b of Hasegawa are equated with the flow tubes, elements 2a and 2b do not have the U-shape. In fact Hasegawa specifically indicates that elements 2a and 2b should be straight. Therefore claim 16 further defines over Hasegawa.

Claim 17 sets forth that vibration sensors are arranged at secondary vibration nodes of said first and second flow tubes. Applicant finds no teaching nor suggestion of arranging vibration sensors at secondary vibration nodes in Hasegawa, and therefore claim 17 further defines over Hasegawa.

Claim 18 sets forth that the inlet and outlet manifolds have a shape to preclude the manifolds from having a particular natural frequency. As Applicant has described above, Hasegawa does not describe manifolds. Applicant further finds no teaching nor suggestion that the structure surrounding elements 3 and 4 in Hasegawa would have a shape to preclude that structure from having a particular natural frequency. Claim 18 therefore further defines over Hasegawa.

Claim 19 sets forth that the inlet and outlet manifolds have a continuously increasing shape without a particular natural frequency. As described previously, Hasegawa does not describe inlet and outlet manifolds, and therefore cannot describe manifolds having a continuously increasing shape without a particular natural frequency. Claim 19 therefore further defines over Hasegawa.

Independent claim 9 sets forth two parallel flow tubes of a curved tube type. The rejection equates the two parallel curved flow tubes of claim 9 with elements 2a and 2b of Hasegawa. Applicant has reviewed Hasegawa, and notes that elements 2a and 2b of Hasegawa are set forth as straight tube portions, see column 4 lines 15 - 17. Applicant notes that the straight tube portions are an important feature of Hasegawa, since Hasegawa relies on the straight tube portions to be less influenced by variation of size and shape, see column 5 lines 19

- 33. Therefore not only does Hasegawa not teach the two parallel curved flow tubes of claim 9, but it would not be obvious to modify Hasegawa to use parallel flow tubes of a curved tube type. Such a modification of Hasegawa would be against the teachings of Hasegawa.

Claim 9 also sets forth a drive unit disposed at a central part of the flow tubes. The rejection equates element 6 of Hasegawa with the drive unit of the present invention. Applicant notes that element 6 is not arranged at a center of elements 2a and 2b. Therefore Hasegawa does not describe a drive unit disposed at a central part of a flow tube, especially when the drive unit of claim 9 is equated with element 6 and the flow tubes are equated with elements 2a and 2b of Hasegawa. Claim 9 therefore further defines over Hasegawa.

Claim 9 sets forth that a coil of the drive unit is connected to one of the flow tubes, and a magnet of the drive unit is connected to the other flow tube. The vibration sensors also have magnets and coils. Claim 9 sets forth that the magnets of the vibration sensors are fitted to the tube which has the coil of the drive unit. Applicant has reviewed Hasegawa, and finds no teaching nor suggestion of a drive unit with a coil and magnet. Applicant further finds no teaching nor suggestion in Hasegawa that one flow tube has a drive magnet and the sensor coils, and that the other flow tube has the drive coil and the sensor magnet. Claim 9 therefore further defines over Hasegawa.

Claim 2 sets forth that a flow path of the inlet side manifold is smoothly curved from the inlet thereof, and branching into two flow tubes while continuously reducing the total cross-sectional area of the flow paths of the two flow tubes. As described above, Hasegawa does not teach nor suggest a manifold, especially a manifold branching into two flow tubes while

continuously reducing the cross-sectional area. Claim 2 therefore further defines over Hasegawa.

Claim 3 sets forth that the inlet and outlet manifolds are formed into curved blocks whose cross-sectional areas continuously increase toward the joint parts with the flow tubes. Hasegawa does not teach nor suggest inlet and outlet manifolds, and therefore cannot teach nor suggest manifolds formed into curved blocks whose cross-sectional areas continue to increase towards joint parts.

Claim 4 sets forth that the meter body of claim 1 has a U-shape cross-section and a box construction having at the upper part thereof a base plate to prevent the meter body from interfering with vibration fulcrums.

As the rejection appears to equate the meter body of claim 1 with element 5a of Hasegawa. Applicant notes that element 5a of Hasegawa does not have any structure to prevent element 5a from interfering with vibration fulcrums. In fact it appears that element 5a of Hasegawa may in fact be a vibration fulcrum. Therefore the further features of the meter body set forth in claim 4 are not anticipated by element 5a in Hasegawa, and claim 4 therefore further defines over Hasegawa.

Claim 5 sets forth that the meter body has a U-shaped case. Applicant notes that element 5a of Hasegawa does not have a U-shaped case, and therefore claim 5 further defines over Hasegawa.

Claim 6 sets forth that the drive unit and the vibration sensors are disposed between the two flow tubes so as to be aligned with the central axis of the two flow tubes. This is further

described in the present specification on page 11 lines 13 - 25. Applicant notes that if elements 7 and 8 of Hasegawa are equated with the vibration sensors of the present application, elements 7 and 8 are not disposed between elements 2a and 2b. Therefore claim 6 further defines over Hasegawa.

Claim 7 sets forth that wiring from the drive unit and the vibration sensors to the outside is provided at the center axis on the inlet and outlet sides of the flow tubes when using flexible printed circuit boards. Applicant finds no teaching nor suggestion of how the wiring is arranged in Hasegawa, and especially of wiring using flexible printed circuit boards. Claim 7 therefore further defines over Hasegawa.

Claim 8 stands in force together with claim 17.

For all of the above reasons, the Board is respectfully requested to overrule the Examiner and to allow each of the claims in the case.

Respectfully submitted
For Applicant,

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65296.14

Enclosed:
Appeal Brief filed in triplicate
Check for $320.00 (Appeal Brief - Large Entity)
Appendix
copy of Page 1169 Webster's New Universal Unabridged Dictionary
Request for Oral Hearing and Check for $280.00 (Oral Hearing - Large Entity)

DATED: August 12, 2002
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BY: Toni Ann Forte DATE: August 12, 2002